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INSTRUCTION MANUAL

MODEL 242

REGULATED HIGH VOLTAGE SUPPLY

KEITHLEY INSTRUMENTS

INSTRUCTION MANUAL

MODEL 242

REGULATED HIGH VOLTAGE SUPPLY

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*Yellow Change Notice sheet included only for instrument modifications affecting the instruction manual.

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SECTION 1. GENERAL DESCRIPTION

1-1. DESCRIPTION. The Keithley Model 242 Regulated High Voltage Supply provides accurate and stable outputs between 300 and 3,500 volts DC. Its maximum current output is 25 milliamperes. Stability is excellent: 0.01% indefinitely after a 30-minute warm-up. Line regulation is within 0.005% for a 10% change in line voltage, and load regulation is within 0.005% from no load to full load. Accuracy is better than ±0.1% of the dial setting throughout the specified voltage range.

1-2. FEATURES.

a. Four in-line calibrated dials set the output voltage in 1-volt steps from 300 to 3,500 volts to an accuracy within 0.1% for all loads. Output can be selected plus, minus, or floated up to 1,000 volts off chassis ground. A trim potentiometer interpolates between steps with a resolution to 15 millivolts.

b. Wire-wound sampling resistors, a photo chopper and a zener diode reference provide an output stable to 0.01% after a 30-minute warm-up. The zener limits overall temperature drift to ±15 PPM/°C maximum.

c. The Model 242 is designed for long-life operation. Heavy duty thermionic diodes are used for rectification in the power supply circuit. Both tubes have peak inverse ratings several times the maximum operating requirement. The photo chopper, a passive device of indefinite life, requires no maintenance. Power transformers are epoxy encapsulated.

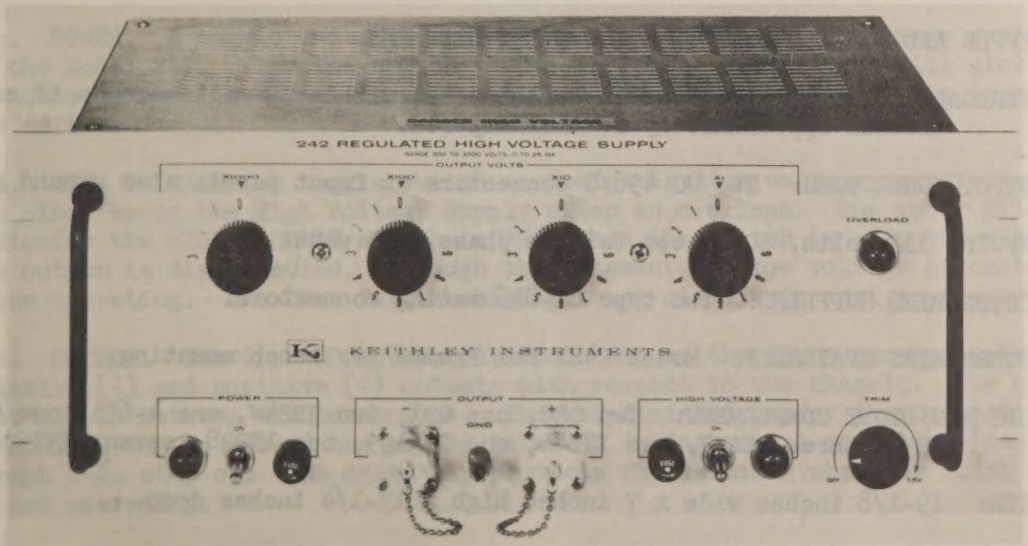


FIGURE 1. Keithley Model 242 Regulated High Voltage Supply (For rack mounting).

1-3. APPLICATIONS. The Model 242 is an excellent voltage source for photo-tubes, photo-multipliers and electron multipliers. The 25-milliampere current capability permits parallel operation of photomultiplier divider strings. Other applications include its use as a source of potential in calibration tests, voltage gradient studies, insulation tests and leakage resistance measurements. In general, the Model 242 is used whenever a well-regulated and stable high voltage source is needed.

1-4. SPECIFICATIONS.

OUTPUT:
VOLTAGE: 300 to 3,500 volts DC.
CURRENT: To 25 milliamperes DC.
POLARITY: Positive or negative with respect to chassis.
FLOATING: One terminal may be operated up to a maximum of 1,000 volts off chassis ground.

ACCURACY OF DIAL SETTINGS: Four in-line dials permit output voltage to be set in 1-volt steps from 300 to 3,500 volts within ±0.1%.

RESOLUTION: A trim potentiometer permits interpolation between steps with a resolution to 15 millivolts.

RESETABILITY: ±0.05%.

STABILITY: 0.01% indefinitely after a 30-minute warmup.

TEMPERATURE DRIFT: ±15 PPM/°C maximum.

LINE REGULATION: 0.005% for 10% change in line voltage.

LOAD REGULATION: 0.005% from zero to full load.

RIPPLE AND NOISE: Less than 1.0 millivolts RMS.

OVERLOAD PROTECTION: Output is disconnected within 25 milliseconds if current exceeds approximately 27 milliamperes.

OUTPUT CONNECTORS: Two UG 496/U connectors on front panel; also ground post.

INPUT: 117 volts, 50-60 cps, single phase, 250 watts.

ACCESSORIES SUPPLIED: Two type 82-816 mating connectors.

ACCESSORIES AVAILABLE: Model 2421 End Frames for bench mounting.

TUBE AND DIODE COMPLEMENT: Two 0B2, one 0G3, two 3B24W, one 4-65A, one 6X4, one 7235, three 12AX7, one 12B4A, one 1N3195, one 1N938, seven 1N3250.

SIZE: 19-1/8 inches wide x 7 inches high x 13-1/4 inches deep.

WEIGHT: 38 pounds.

TABLE 1. Table of Specifications.

SECTION 2. OPERATION

2-1. EQUIPMENT RECEIVED. The Model 242 High Voltage Supply is factory-calibrated before it is shipped. Two vacuum tubes, the 7235 (circuit designation V4) and the 4-65A (V12), are packed separately to prevent damage during shipping. Refer to paragraph 4-7 and Figure 6 for installing the tubes. Both output connectors are capped, one with a red shorting cap and the other with a plain protective cap.

2-2. REGISTRATION CARD. The registration card is attached to the front cover of the Instruction Manual. Please fill it out and mail it when you receive the instrument.

2-3. DAMAGE IN SHIPMENT. If the Model 242 is damaged or faulty when received, follow the instructions given at the back of the manual for reporting the defect.

2-4. ACCESSORIES. The Model 242 is designed for rack mounting and requires Model 2421 End Frames for bench use. The pair of end frames, which comes with rubber feet and mounting hardware, easily fastens to the High Voltage Supply. Order through the Order Service Department, Keithley Instruments, Inc.

2-5. CONTROLS. (See Figure 2.)

a. OUTPUT VOLTS. Four skirted dials, calibrated in 1000-volt, 100-volt, 10-volt and 1-volt steps, set the output voltage from 300 to 3,500 volts DC.

b. TRIM. The TRIM dial extrapolates between 1-volt settings with a resolution of 15 millivolts. The range of the control is between zero and 1.5 volts.

c. POWER. A toggle switch energizes the filament and low voltage supplies to the Model 242. When the switch is ON, the power pilot light will glow green to indicate the instrument is on. The fuse for the control circuits is next to the switch.

d. HIGH VOLTAGE. A toggle switch controls the high voltage output circuits and also resets the High Voltage Supply after an overload. The amber pilot light indicates the HIGH VOLTAGE switch is ON. When the switch is off, the high voltage output is disconnected, although the filament and low voltage circuits continue operating. The fuse for the high voltage circuit is next to the switch.

e. OUTPUT. Two type UG 496/U connectors are on the front panel, marked for negative (-) and positive (+) outputs with respect to the chassis. The ground post GND is between the connectors. The red-finished cap on the connector is a SHORTING CAP to ground the unused terminal during normal operation (see paragraph 2-6, step c). The other cap protects the terminal when the Model 242 is not operating.

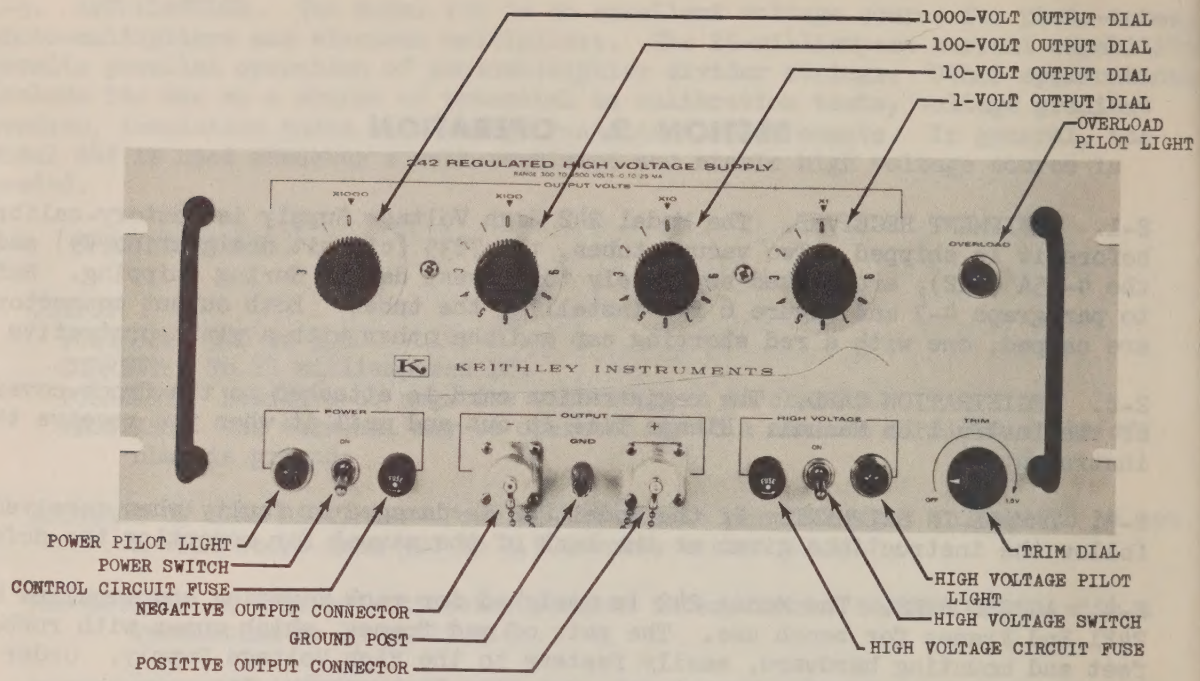


FIGURE 2. Front Panel Controls.

f. OVERLOAD. When the output current is approximately 2 milliamperes above the maximum current rating, the overload relay opens only the high voltage output circuit and lights the red OVERLOAD pilot light on the front panel. The OVERLOAD pilot light also lights for settings below 300 volts.

2-6. OPERATING PROCEDURES.

a. Keep the POWER, HIGH VOLTAGE and TRIM controls off. Connect the power line at the back of the cabinet to an outlet. Unless otherwise specified on the instrument, the Model 242 connects into 117 volts, 50-60 cps, single phase.

b. Put the POWER switch in ON position. Select the output voltage by setting the four OUTPUT VOLTS dials between 300 and 3,500 volts.

NOTE

Make sure the TRIM control is in OFF position. If this control is on, up to 1.5 volts will be added to the desired output, creating the appearance of an erroneous output.

c. Connect the load to the Model 242. Two Amphenol 82-816 connectors, furnished with the High Voltage Supply, mate with the type UG 496/U connectors. For positive polarity output, connect the cable to the + OUTPUT terminal and fasten the red

shorting cap to the - OUTPUT terminal to ground the negative line. The + OUTPUT connector has its center terminal at positive polarity and its shell at negative polarity. Reverse procedures for negative polarity output.

d. Allow the High Voltage Supply 30 seconds to warm up. Put the HIGH VOLTAGE switch in ON position.

NOTE

The OVERLOAD bulb will light if the HIGH VOLTAGE switch is ON when the POWER switch is turned on, or if the circuits are not warmed up. When the OVERLOAD bulb lights, put the HIGH VOLTAGE switch off and wait 30 seconds. Then put on HIGH VOLTAGE.

e. Use the TRIM dial for settings between 1-volt steps. Resolution is better than 15 millivolts. Let the Model 242 warm up for approximately 30 minutes for maximum stability in output.

f. To reset output voltage or to change terminals, put the HIGH VOLTAGE switch off, make the change, and turn the switch ON. It is not necessary to turn the POWER switch off.

2-7. OVERLOADS. If the red OVERLOAD bulb lights, the circuit is overloaded and the output is disconnected. To reset the Model 242, snap the HIGH VOLTAGE switch off and then on again. If the OVERLOAD bulb again lights, put the HIGH VOLTAGE switch off and wait 30 seconds before putting it on again. Refer to paragraph 4-6 if the OVERLOAD bulb still lights.

2-8. FLOATING OPERATION. Remove the shorting cap from the connector. Use two separate shielded coaxial cables, type RG-149/U or equivalent, for the connectors, one for positive and one for negative polarity. Use only connectors and the shielded cables because of the high potentials present.

NOTE

Do not exceed 1000 volts on either line. Because of the high voltages present, make sure all instructions are understood and followed before attempting floating operations.

SECTION 3. CIRCUIT DESCRIPTION

3-1. GENERAL CIRCUIT DESCRIPTION. (See Figure 3.)

a. The Model 242 furnishes a regulated, stable output to 3,500 volts DC from a 110-volt AC source. The block diagram, Figure 3, shows the relationship between the operating components.

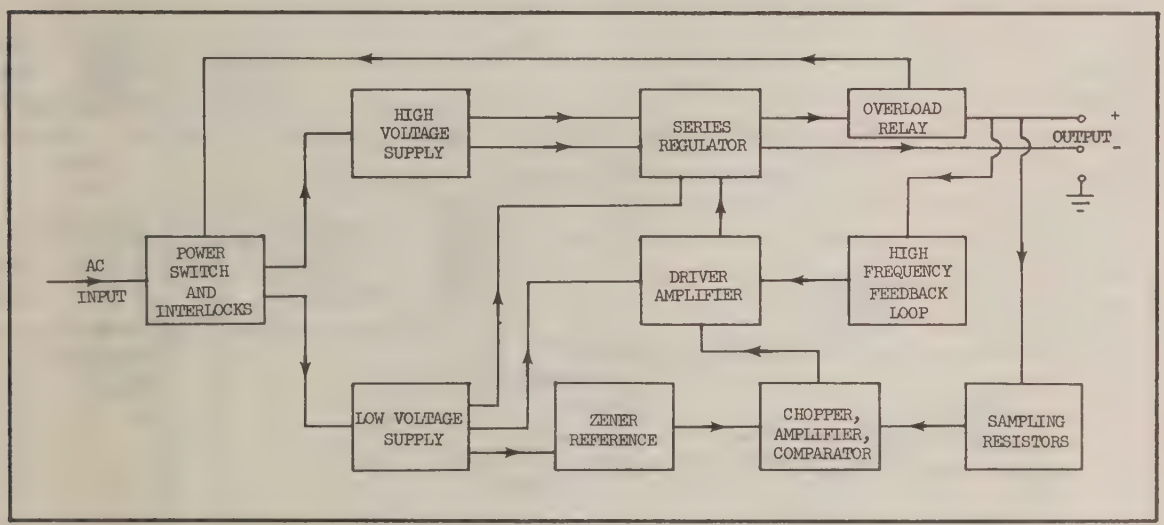


FIGURE 3. Model 242 Block Diagram.

b. The output voltage is selected by setting the sampling resistors. The voltage is compared against the zener reference, and an error signal is developed, amplified and returned to the series regulator. The series regulator, in series with the high voltage supply, controls the output by varying the voltage drop across itself. The low voltage supply generates regulated voltages for all circuits other than the output.

3-2. AC CONTROL CIRCUITS. (See Figure 4.)

a. Closing the POWER switch S1 completes the circuit from the AC input source to the low voltage supply and the filament transformer T3. If the HIGH VOLTAGE switch S4 is in stand-by position, the control relay K2 will close. The circuit to the high voltage supply will now operate when the HIGH VOLTAGE switch is turned on.

b. If the HIGH VOLTAGE switch is ON when the POWER switch is put on, the circuit activating the control relay is not complete. Therefore, the high voltage supply can not operate, even though the low voltage supply is operating.

c. Several safety devices in the AC control circuits protect the Model 242. The overload relay K1 breaks the circuit to the control relay and to the high voltage supply if the output current exceeds approximately 27 milliamperes. The decade interlocks S5 and S6 will not close unless the output is set for more than 300 volts. The interlocks S2 and S3 break the circuit to the high voltage supply if either the cover or the bottom of the Model 242 is not on.

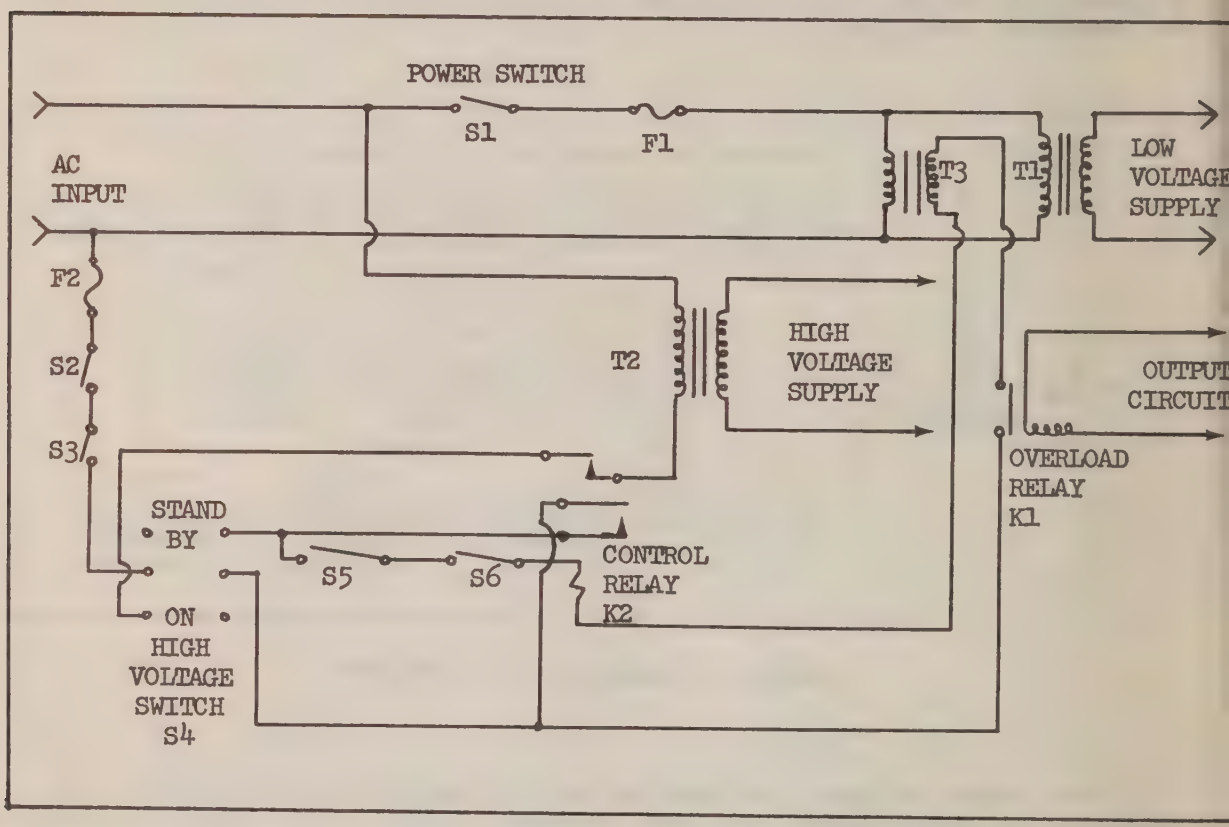


FIGURE 4. AC Control Circuits Simplified Diagram. (All circuits open.)

3-3. LOW VOLTAGE SUPPLY. The low voltage supply transformer T1 provides regulated B+ voltages to the entire unit. A separate winding and the tube, V9, provide a regulated 105 volts to the screen of the series regulator tube, V12. The low voltage supply also provides the gating voltage for the diode bridge demodulator, D106 to D109.

3-4. HIGH VOLTAGE SUPPLY. The high voltage supply develops the high DC output voltage. The entire primary winding of the transformer T2 is used for output voltages below 2000 volts and half the winding for higher voltages. Two rectifiers, V10 and V11, convert the transformer output to DC voltage for the series regulator.

3-5. REGULATOR CIRCUIT. (See Figure 5.)

a. The regulator circuit compares the actual voltage at the output terminals and the voltage selected with the OUTPUT dials. If a difference exists, the circuit amplifies and returns a signal to the series regulator to correct the output.

b. For low frequency fluctuations at the output, the sampling resistors on the decade switches divide the output voltage. The zener reference voltage (across zener diode D103) and the divided output voltage are compared across R137 and the photo chopper. The chopper develops an AC signal if a DC potential difference exists. The signal is then amplified by V2 and demodulated by the diode bridge, D106 to D109. The DC signal is further amplified by V3 and V4 and applied to the bias of the series regulator tube, V12.

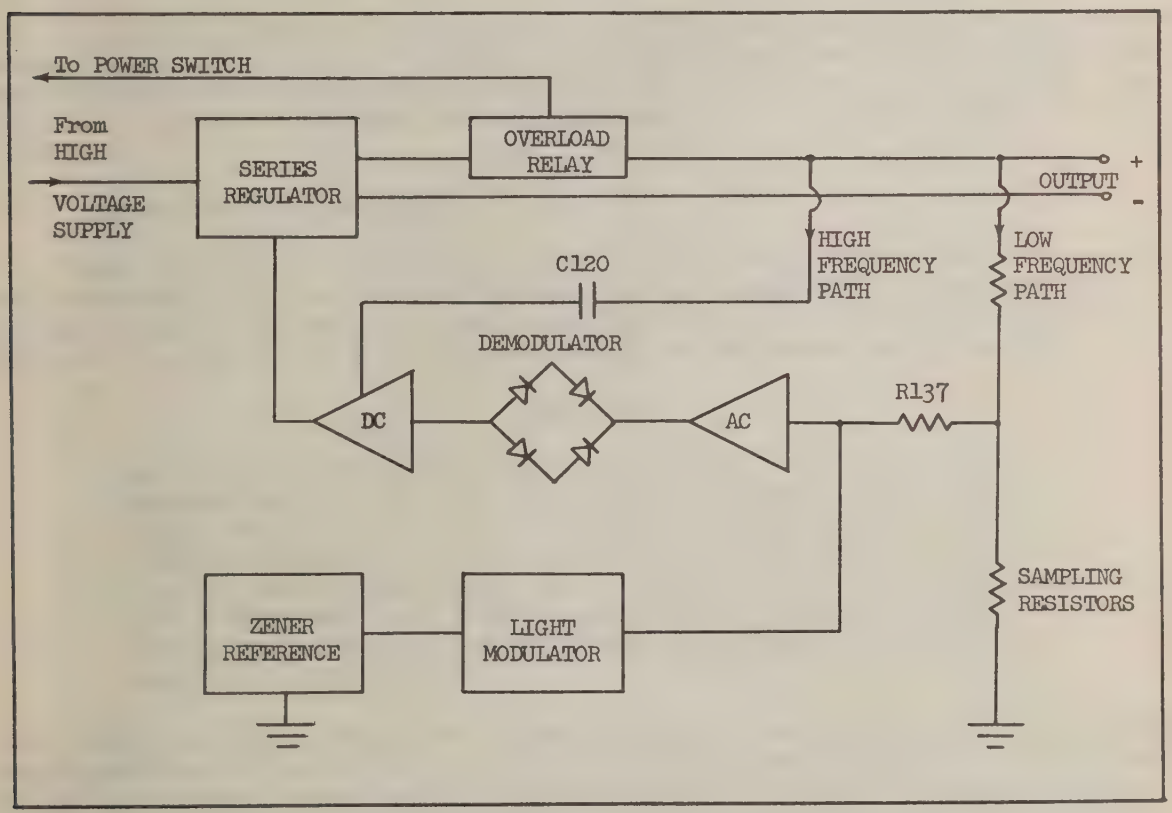


FIGURE 5. Regulator Circuit Simplified Diagram.

c. For high frequency fluctuations and transients in the output, the feedback loop is through capacitor C120 to the grid of V4, which applies the signal to the bias of V12. The regulator path described in paragraph b above does not operate for high frequency transients.

SECTION 4. MAINTENANCE

4-1. GENERAL CARE.

a. Under normal usage, the Model 242 High Voltage Supply requires little maintenance. High quality components are used at manufacture and the circuits are designed for reliability and long life. A visual inspection of components whenever the cover is off and a periodic calibration (every six or twelve months) is the normal maintenance schedule.

b. The trouble shooting procedures in the following paragraphs give instructions to make repairs for specific troubles. If the difficulties cannot be eliminated, write or phone the Service Department, Keithley Instruments, Inc. Describe the trouble as completely as possible, and give the Model and Serial Number of the instrument.

4-2. TROUBLE SHOOTING PROCEDURES.

a. Take off the cover of the Model 242 (see paragraph 4-7). Apply no load to the instrument. Put the red shorting cap on the negative (-) output terminal. Set the output to 300 volts and make sure the TRIM control is OFF. Put on the POWER and the HIGH VOLTAGE switches according to the operating instructions.

CAUTION

BE CAREFUL WHEN WORKING INSIDE THE CHASSIS. SAFETY INTERLOCKS PREVENT THE HIGH VOLTAGE CIRCUITS FROM WORKING, BUT IF THE POWER SWITCH IS ON, UP TO 200 VOLTS APPEAR AT POINTS IN THE CONTROLS CIRCUITS. IF THE INTERLOCKS ARE DEFEATED FOR ANY PURPOSE, USE EXTREME CARE. HIGH VOLTAGE APPEARS ON BOTH SIDES OF THE CHASSIS. WHEN WORKING ON A DISABLED VOLTAGE SUPPLY, REMOVE THE LINE POWER AND DISCHARGE ALL FILTER CAPACITORS BEFOR MAKING REPAIRS.

b. Check the vacuum tubes before proceeding with the trouble shooting. Normally, replacing tubes will clear up the difficulty. All tubes except V4, V10, V11 and V12 can be readily tested on a grid modulated tube tester. Check the remaining tubes by replacing the suspected tube. If tubes are good but the trouble remains, continue the trouble shooting procedures.

c. All measurements given in the following paragraphs are with respect to chassis ground. Refer to the schematic diagram, DR14661D, at the back of the manual for voltages at specific points.

4-3. TROUBLE: NO OUTPUT.

a. Check both fuses on the front panel. The HIGH VOLTAGE pilot light indicates when it is possible to have high voltage output, but it can light even when the fuse is blown. Replace defective fuses. If the fuse again blows, check further for the cause.

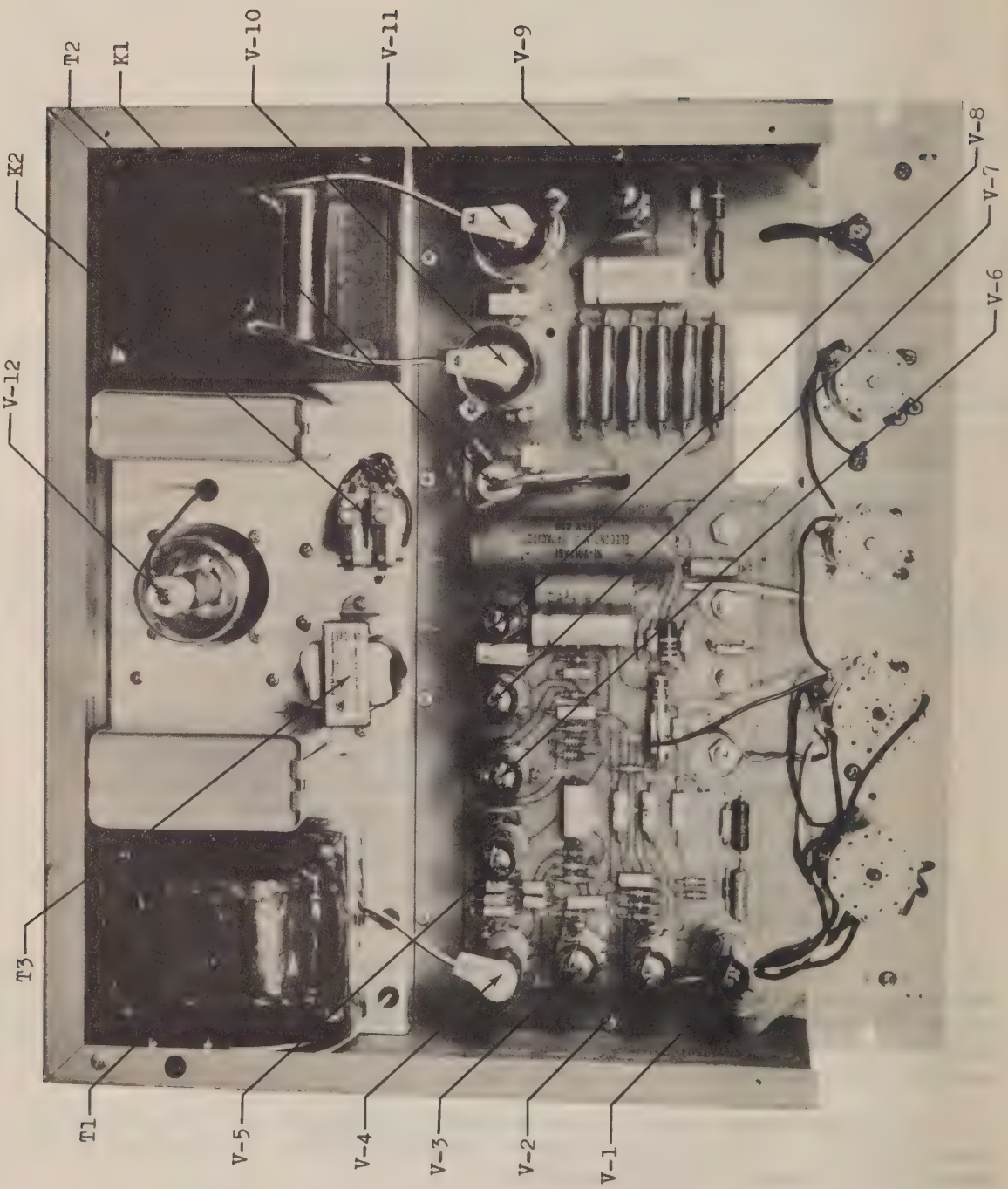


FIGURE 6. Sheet 1. Internal Components Location Top View. (Front panel hinged down.)

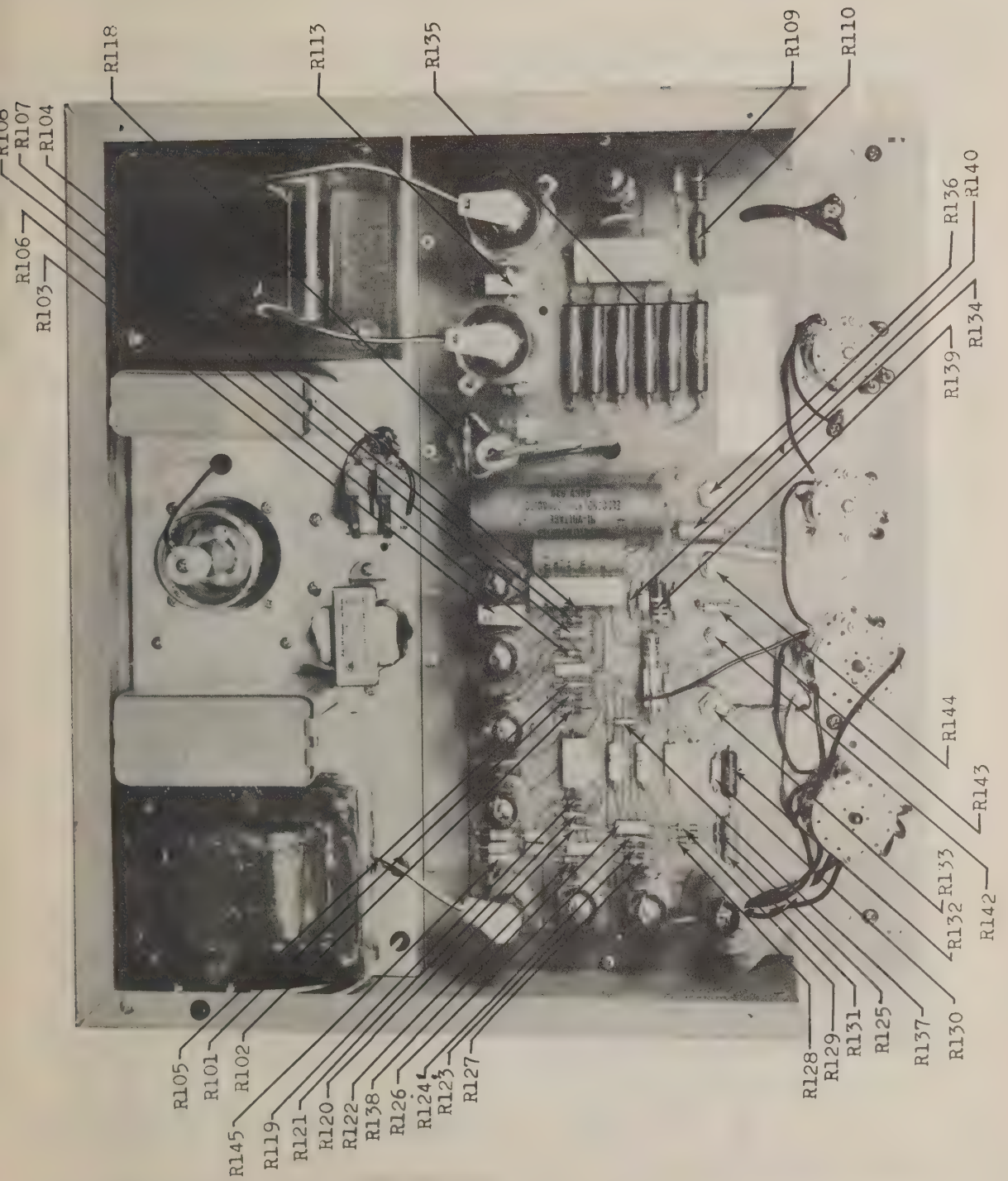


FIGURE 6. Sheet 2. Internal Components Location Top View. (Front panel hinged down.)

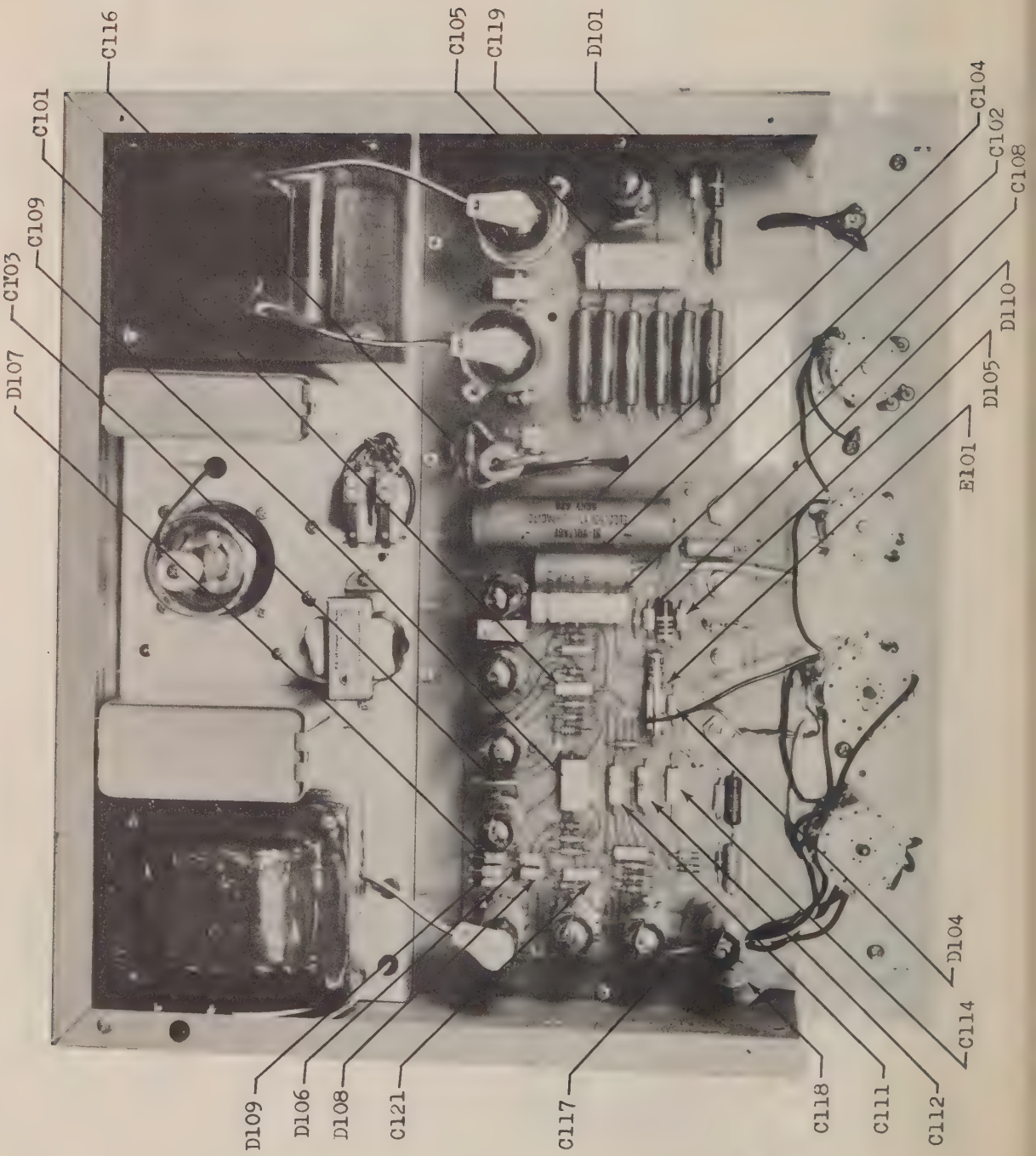


FIGURE 6. Sheet 3. Internal Components Location Top View. (Front panel hinged down.)

b. Measure the plate voltage of V12 with a DC voltmeter which will measure up to 4000 volts. Make sure the OUTPUT VOLTAGE is set at 300 volts before making this measurement. The plate voltage should be 3000 volts, ±20%.

c. If the plate voltage is not correct, check rectifiers V10 and V11, the series resistor R113, the filter capacitor C106 and the primary winding of transformer T2 for 117 volts AC. If no voltage appears on the transformer primary, check the overload relay K1 and the control relay K2.

d. If the plate voltage of V12 is correct, check the cathode voltage across pins 1 and 7. The voltage should be approximately 300 volts.

e. Incorrect voltage at the cathode indicates a faulty power tetrode tube or incorrect biasing conditions. If the voltage is still incorrect after V12 is replaced, check the triode V4, the DC amplifier tube, V3, the AC amplifier tube, V2, and the diodes D106 to D109 in the demodulating bridge.

f. If the plate voltage of V12 is correct, check the overload relay K1. Refer to paragraph 4-6.

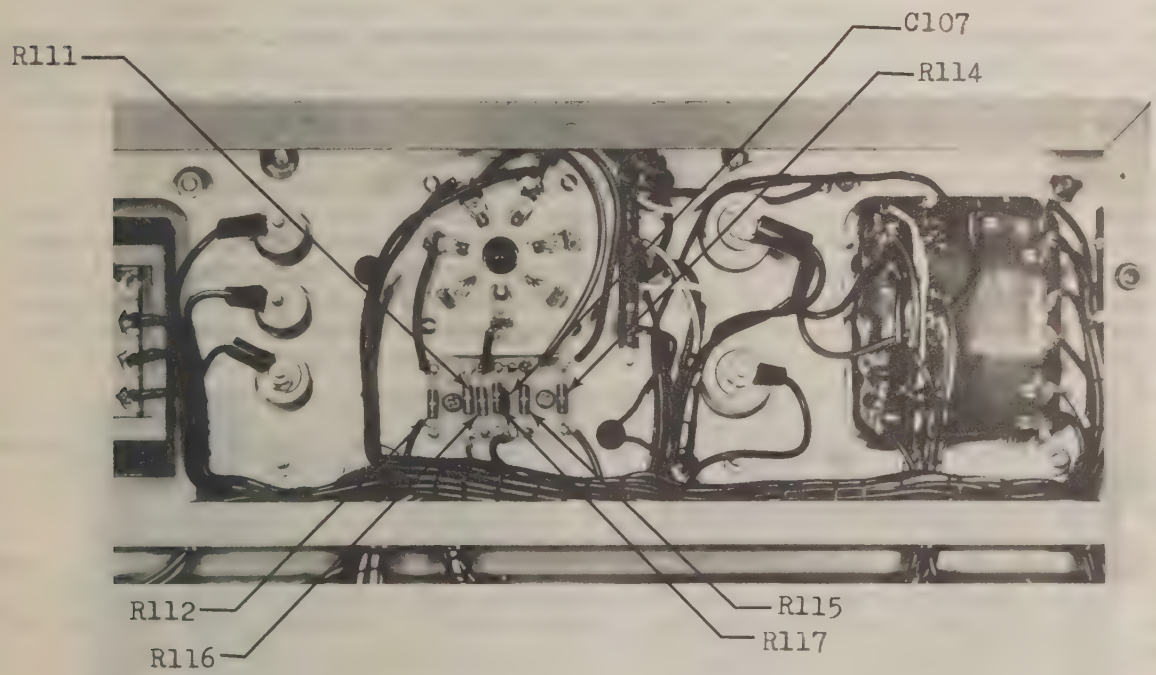


FIGURE 7. Internal Components Location Bottom View.

4-4. TROUBLE: IMPROPER VOLTAGE OUTPUT.

a. Poor regulation or excessive drift could result from several factors. Check the following for proper operation.

b. If capacitor C115 is defective, it will cause the output to be unstable.

c. Although it will not normally need replacement, check the zener diode D103. Since adjusting the diode circuit requires readjusting the entire instrument, chec the zener diode only after other possible trouble sources are eliminated.

1. Remove the jumper in series with D103, (the jumper location is marked ZENER CAL POINT on the schematic diagram) and put a 10-ohm $\frac{1}{2}$% resistor in the circuit. Put a DC millivoltmeter accurate to 2%, such as the Keithley Model 149, 150A or 151, across the 10-ohm resistor. Adjust the ZENER ADJ, R133 (see Figure 8) until the voltmeter reads exactly the product of the rated zener current (7.5 milliamperes) times the resistance (10 ohms). It should read 75 millivolts.

2. The voltage across the zener diode should now be between 8.55 and 9.45 volts. If this voltage is incorrect, check the regulator tube V1, the resistor R132, the ZENER ADJ potentiometer R133 and the zener diode.

4-5. TROUBLE: EXCESSIVE NOISE.

a. Adjust the bias according to the instructions in paragraph 4-12. Maintain the setup if the BIAS ADJ potentiometer R144 does not have sufficient range to minimize noise.

b. If capacitor C108 is open, it will cause excessive noise. If C108 is good, observe the output wave on an oscilloscope (see Figure 10). A high level of corona in the output voltage indicated feedback capacitor C120 is open or the core of transformer T2 is grounded.

4-6. TROUBLE: OVERLOAD NOT WORKING PROPERLY.

a. If the OVERLOAD lamp keeps lighting when the instrument is turned on, turn the instrument off and remove the load. If the instrument works when the load is not present, the overload is in the external circuit. If the instrument continues to show an overload with the load disconnected, check the Model 242 for the trouble. Trace the circuits using the voltages marked on the schematic diagram at the various points for the test values.

b. If the overload relay, K1, will not break the circuit when the High Voltage Supply becomes overloaded, check filter capacitor C116 for a short and check the overload relay for proper operation.

c. If the overload relay cuts off the circuit when no overload is present, chec the coil of overload relay K1 against the rated value printed on the component. Also check the shunting resistance R118 to make sure its value is the same as originally rated.

d. If previous checks have not located the source, check capacitor C115. A leaky or shorted capacitor here will cause troubles similar to those caused by a faulty overload circuit.

4-7. COVER REMOVAL. Four No. 6-32UNC-2x$\frac{1}{4}$ slotted machine screws -- one in each corner -- fasten the cover to the cabinet. Remove all the screws to remove the cover. The bottom fastens to the cabinet in the same way. Three Phillips flat head machine screws on each side attach the front panel to the cabinet sides.

Remove the screws on both sides and the front panel will swing down to the position shown in Figure 6.

CAUTION

REMOVE THE LINE POWER BEFORE DISMANTELING THE CABINET. AFTER THE COVER IS OFF, DISCHARGE ALL METAL-CASED CAPACITORS BEFORE PROCEDDING WITH REPAIRS.

4-8. PARTS REPLACEMENT. The Replaceable Parts List, Section 5, describes all the electronic components in the Model 242. Use only reliable replacements which meet the specifications. Replace components only as necessary. Make sure parts listed as manufactured by Keithley Instruments, Inc., are bought only from Keithley. All structural parts are purchased direct from Keithley Instruments, Inc.

4-9. SOLDERING.

a. Be careful when soldering near the printed circuit board. Observe the following procedures during these repairs.

b. To remove a component, cut the leads near the component. Use needle nose pliers to grip the lead and heat the lead with the soldering iron between the pliers and the circuit board. Pull gently on the lead, and when the solder softens, the lead will pull out. If it does not leave a clean hole, open it with a scribe or pointed tool.

c. Put the new component in the same physical location as the replaced part. Make sure the diodes and capacitors are placed according to positive and negative polarity. Use needle nose pliers between the soldering point and the component to act as a heat shunt. Use the soldering iron for short intervals; handle components carefully. Avoid applying heat to the printed circuit board; excessive heat will damage the printed wiring.

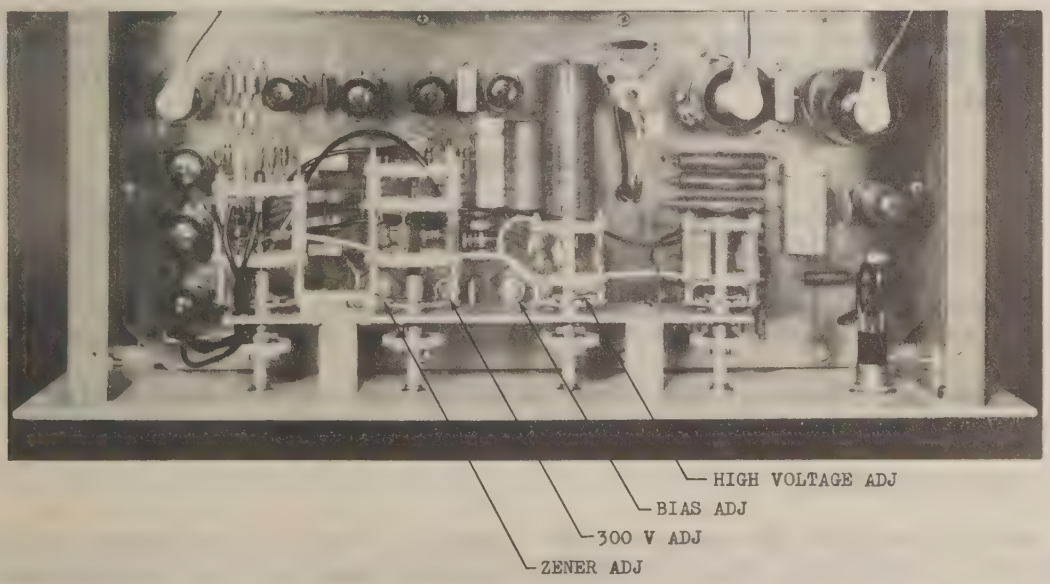


FIGURE 8. Internal Calibration and Adjustment Controls.

4-10. CALIBRATION. The following procedures should be followed whenever necessary to check the accuracy of the High Voltage Supply. If the zener diode, the series regulator tube and other critical components are replaced, recalibrate the instruments.

4-11. OUTPUT CALIBRATION.

a. Set up the Model 242 according to Figure 9. The calibration will involve the following types of instruments:

1. A volt box which will accommodate a minimum input of 4000 volts to divide the high voltage output of the Model 242. The division rating of the Keithley calibrating instrument is accurate to ±0.01%.

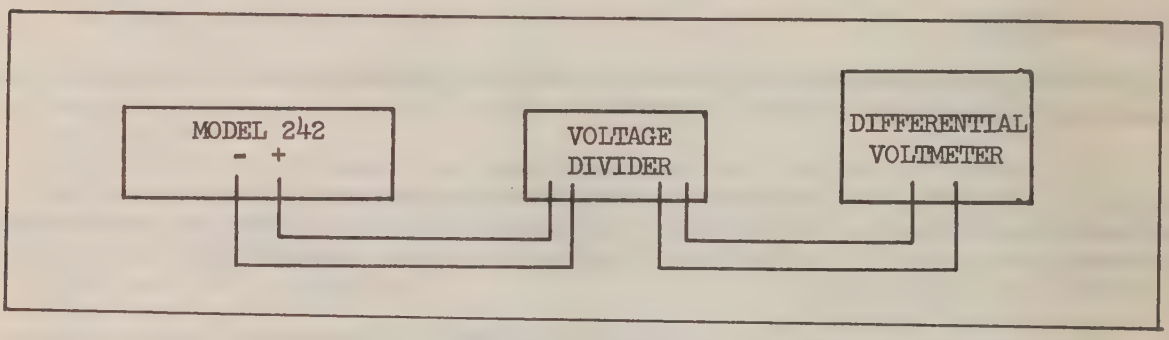


FIGURE 9. Ouput Calibration Block Diagram.

2. A DC Differential Voltmeter accurate to ±0.05%.

b. Turn on the Model 242. Set the output to 3,500 volts and make sure the TRIM control is off before making the calibration. Make a reading on the voltmeter. Adjust the HIGH VOLTAGE ADJ potentiometer (see Figure 8) until the output reads 3,500 volts.

CAUTION

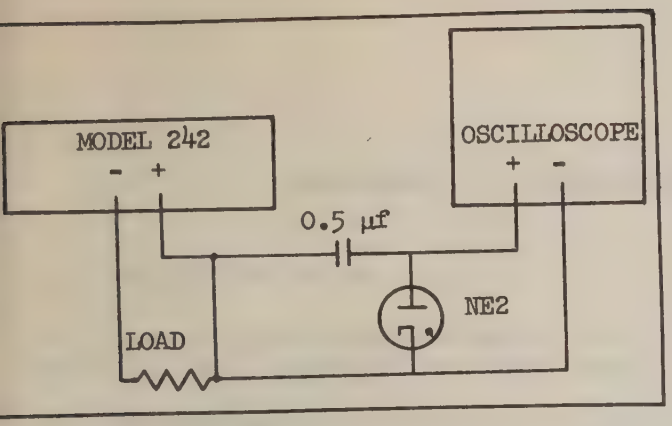
BE CAREFUL MAKING THIS ADJUSTMENT. 3,500 VOLTS DC IS PRESENT INSIDE THE MODEL 242.

c. Set the output to 300 volts and make a reading on the voltmeter. Adjust the 300 V ADJ potentiometer (see Figure 8) until the voltmeter reads 300 volts.

d. Repeat steps b and c until there is no discrepency between the High Voltage Supply setting and the voltmeter reading at either setting.

4-12. BIAS ADJUSTMENT.

a. Set up the Model 242 according to Figure 10. Use any load within the specifications of the unit. Use a 4000-volt blocking capacitor (0.5 microfarads) in series with the oscilloscope for protection.



b. Turn the High Voltage Supply on and monitor the wave on the oscilloscope. The oscilloscope should show 1 millivolt RMS waves. Adjust the BIAS ADJ potentiometer (see Figure 8) until the minimum wave appears on the oscilloscope. If the calibration does not appreciably lessen the noise, check the Model 242 as instructed in paragraph 4-5.

FIGURE 10. Bias Adjustment Diagram.

SECTION 5. REPLACEABLE PARTS LIST

5-1. HOW TO ORDER PARTS.

a. Order component parts directly from the manufacturer or from Keithley Instruments, Inc. Order all structural parts from Keithley.

b. The Replaceable Parts List gives the Circuit Designation of the component on the Schematic Diagram, the component specifications, the code number of the manufacturer, and the Keithley Part Number. The name and address of the manufacturer is listed according to code number in Table 3, Manufacturers' Code Definitions. When ordering parts from the manufacturer, purchase only quality components meeting the listed specifications. All aged or matched tubes should be ordered from Keithley Instruments, Inc.

c. When ordering from Keithley Instruments, give a description of the part being ordered, the circuit designation, the Keithley part number, the instrument model number and the instrument serial number. Send to:

Order Service Department
Keithley Instruments, Inc.
12415 Euclid Avenue
Cleveland 6, Ohio

a	Amperes	M	Mega (10^6)
		m	Milli (10^{-3})
CbV	Carbon Variable	My	Mylar
Cer	Ceramic Disc		
Comp	Composition	Ω	Ohm
DCb	Deposited Carbon	p	Pica (10^{-12})
ETB	Electrolytic Tubular	μ	Micro (10^{-6})
f	Farad	V	Volts
K	Kilo (10^3)	w	Watts
		WW	Wire Wound
		WWV	Wire Wound Variable

TABLE 2 - ABBREVIATIONS AND SYMBOLS

CAPACITORS

Circuit Desig.	Value	Rating	Type	Mfg. Code	Keithley Part No.
C101	0.1 µf	200 V	My	02777	C66-.1
C102	10 µf	450 V	ETB	83125	C8-10
C103	.01 µf	600 V	Cer	01121	C22-.01
C104	20 µf	600 V	ETB	14655	C35-20
C105	20 µf	350 V	ETB	80183	C23-20
C106	.5 µf	6000 V	My	99120	C74-.5
C107	100 pf	600 V	Cer	19701	C22-100
C108	100 µf	25 V	ETB	80183	C10-100
C109	1.0 µf	200 V	My	72928	C66-1.0
C110	Not Used				
C111	2 µf	50 V	ETB	37942	C39-2
C112	2 µf	50 V	ETB	37942	C39-2
C113	.01 µf	600 V	Cer	01121	C22-.01
C114	0.1 µf	200 V	My	02777	C66-.1
C115	.05-.5 µf	5000 V	My	99120	C51-.05/.5
C116	.02 µf	600 V	Cer	72982	C22-.02
C117	.0022 µf	1000 V	Cer	80183	C72-.0022
C118	.01 µf	600 V	Cer	01121	C22-.01
C119	.01 µf	600 V	Cer	01121	C22-.01
C120	.005 µf	6000 V	Cer	71590	C75-.005
C121	.1 µf	200 V	My	02777	C66-.1

DIODES

Circuit Desig.	Type	Number	Mfg. Code	Keithley Part No.
D101	Diffused Silicon	1N3195	02735	RF-17
D102	Not Used			
D103	Zener, Silicon	1N938	04713	DZ-6
D104	Diffused Silicon	1N3253	02735	RF-20
D105	Diffused Silicon	1N3253	02735	RF-20
D106	Diffused Silicon	1N3253	02735	RF-20
D107	Diffused Silicon	1N3253	02735	RF-20
D108	Diffused Silicon	1N3253	02735	RF-20
D109	Diffused Silicon	1N3253	02735	RF-20
D110	Diffused Silicon	1N3253	02735	RF-20

MISCELLANEOUS

Circuit Desig.	Description	Mfg. Code	Keithley Part No.
DS1	Pilot Light, Green lens	72619	PL-13G
DS2	Pilot Light, Red lens	72619	PL-13R
DS3	Pilot Light, Amber lens	72619	PF-13A
E101	Light Modulator	80164	CV-4
F1	Fuse, 1.5A-3AG	75915	FU-8
F2	Fuse, 2A-3AG	75915	FU-13
J1	Connector (UG 496/U)	02660	CS-79
J2	Connector (UG 496/U)	02660	CS-79
K1	Relay, Overload (Vendor No. W103X-10)	94696	RL-17
K2	Relay, 6 VAC, (Vendor No. MW2A-6VAC)	94696	RL-16
P1	Cord Set, 6-ft.	80164	CO-2
T1	Transformer, Power (Vendor No. P1-13384)	95970	TR-47
T2	Transformer, HiVoltage (Vendor No. A1-13469)	95970	TR-48
T3	Transformer, Filament (Vendor No. P-6134)	12080	TR-46

RESISTORS

Circuit Desig.	Value	Rating	Type	Mfg. Code	Keithley Part No.
R101	33 KΩ	10%, ½ w	Comp	44655	R1-33K
R102	33 KΩ	10%, ½ w	Comp	44655	R1-33K
R103	500 Ω	10%, 5 w	WW	63743	R4A-500
R104	10 MΩ	10%, ½ w	Comp	01121	R1-10M
R105	220 KΩ	10%, ½ w	Comp	44655	R1-220K
R106	10 MΩ	10%, ½ w	Comp	01121	R1-10M
R107	1 MΩ	1%, ½ w	DCb	01661	R12-1M
R108	600 KΩ	1%, ½ w	DCb	01661	R12-600K
R109	2.2 KΩ	10%, 2 w	Comp	01121	R3-2.2K
R110	10 KΩ	10%, 5 w	WW	44655	R4A-10K

RESISTORS (cont'd)

Circuit Desig.	Value	Rating	Type	Mfg. Code	Keithley Part No.
R111	2.2 MΩ	10%, ½ w	Comp	01121	R1-2.2M
R112	100 Ω	10%, ½ w	Comp	44655	R1-100
R113	1 KΩ	10%, 5 w	WW	44655	R4A-1K
R114	100 Ω	10%, ½ w	Comp	44655	R1-100
R115	100 Ω	10%, ½ w	Comp	44655	R1-100
R116	100 Ω	10%, ½ w	Comp	44655	R1-100
R117	56 KΩ	10%, ½ w	Comp	01121	R1-56K
R118	235 Ω*	1%, ½ w	DCb	01661	R12-235
R119	100 Ω	10%, ½ w	Comp	44655	R1-100
R120	220 KΩ	10%, ½ w	Comp	44655	R1-220K
R121	220 KΩ	10%, ½ w	Comp	44655	R1-220K
R122	10 MΩ	10%, ½ w	Comp	01121	R1-10M
R123	10 KΩ	10%, ½ w	Comp	44655	R1-10K
R124	1 MΩ	10%, ½ w	Comp	01121	R1-1M
R125	1 MΩ	10%, ½ w	Comp	01121	R1-1M
R126	22 KΩ	10%, ½ w	Comp	44655	R1-22K
R127	10 MΩ	10%, ½ w	Comp	01121	R1-10M
R128	22 KΩ	10%, ½ w	Comp	44655	R1-22K
R129	330 KΩ	10%, ½ w	Comp	01121	R1-330K
R130	150 KΩ	1%, ½ w	DCb	01661	R12-150K
R131	5 KΩ	10%, 5 w	WW	63743	R4A-5K
R132	10 KΩ	10%, 5 w	WW	44655	R4A-10K
R133	5 KΩ	10%, 2 w	WWV	12697	RP9-5K
R134	220 KΩ	10%, ½ w	Comp	44655	R1-220K
R135 a-f	162.5 KΩ	1%, 10 w	WW	91637	R34-162.5K
R136	50 KΩ	2 w	WWV		RP32A-50K
R137	220 KΩ	10%, ½ w	Comp	44655	R1-220K
R138	7.8 MΩ	1%, ½ w	DCb	01661	R12-7.8M
R139	470 Ω	10%, 2 w	Comp	44655	R3-470
R140	6 MΩ	1%, 1 w	DCb	00327	R13-6M
R141	50 KΩ	2 w	WWV	12697	RP9B-50K
R142	1 MΩ	½ w	CbV	75042	RP2A-1M
R143	5 KΩ	1%, ½ w	DCb	01661	R12-5K
R144	20 KΩ	20%, ¼ w	CbV	71450	RP7-20K
R145	100 KΩ	1%, ½ w	DCb	01661	R12-100K
R146	100 KΩ	1%, ½ w	DCb	01661	R12-100K
R201	9 KΩ	.1%, 1/3 w	WW	15909	R11-9K
R202	9 KΩ	.1%, 1/3 w	WW	15909	R11-9K
R203	9 KΩ	.1%, 1/3 w	WW	15909	R11-9K
R204	90 KΩ	.1%, 1/3 w	WW	15909	R11-90K
R205	45 KΩ	.1%, 1/3 w	WW	15909	R11-45K

*Adjusted at factory.

RESISTORS (cont'd)

Circuit Desig.	Value	Rating	Type	Mfg. Code	Keithley Part No.
R206	22.5 KΩ	.1%, 1/3 w	WW	15909	R11-22.5K
R207	22.5 KΩ	.1%, 1/3 w	WW	15909	R11-22.5K
R208	900 KΩ	±¼%, 1/3 w	WW	15909	R10-900K
R209	450 KΩ	±¼%, 1/3 w	WW	15909	R10-450K
R210	225 KΩ	±¼%, 1/3 w	WW	15909	R10-225K
R211	225 KΩ	±¼%, 1/3 w	WW	15909	R10-225K
R212	9 MΩ	±1%, 1 w	DCb	15909	R13-9M
R213	4.5 MΩ	±1%, 1 w	DCb	15909	R13-4.5M
R214	2.25 MΩ	±1%, 1 w	DCb	15909	R13-2.25M
R215	2.25 MΩ	±1%, 1 w	DCb	15909	R13-2.25M

SWITCHES

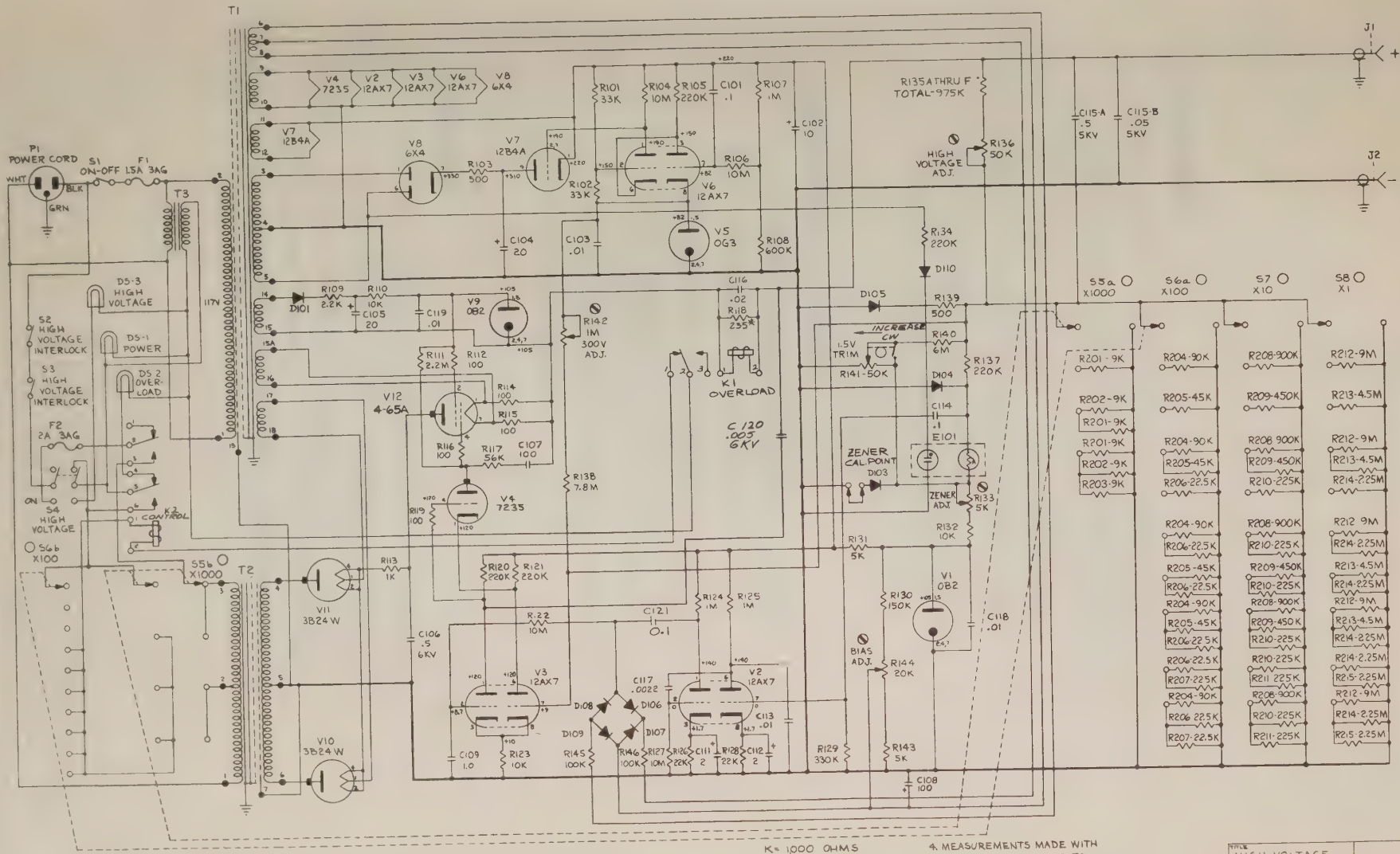
Circuit Desig.	Description	Mfg. Code	Keithley Part No.
S-1	Toggle Switch, SPST	80164	SW-133
S-2	Switch (Vendor No. 1PL4)	91929	SW-129
S-3	Switch (Vendor No. 1PL4)	91929	SW-129
S-4	Toggle Switch, DPDT	80164	SW-134
S-5	Switch, Rotary	80164	SW-130
S-6	Switch, Rotary	80164	SW-131
S-7	Switch, Rotary	80164	SW-132
S-8	Switch, Rotary	80164	SW-132

VACUUM TUBES

Circuit Desig.	Number	Mfg. Code	Keithley Part No.
V-1	OB2	73445	EV-OB2
V-2	12AX7	80164	EV-12AX7
V-3	12AX7	80164	EV-12AX7
V-4	7235	86684	EV-7235
V-5	OG3	73445	EV-OG3
V-6	12AX7	80164	EV-12AX7
V-7	12B4A	24446	EV-12B4A
V-8	6X4	49956	EV-6X4
V-9	OB2	73445	EV-OB2
V-10	3B24W	86684	EV-3B24W
V-11	3B24W	86684	EV-3B24W
V-12	4-65A	06980	EV4-65A

TABLE 3. Manufacturers' Code Definitions.

00327	Welwyn International, Inc. Cleveland, Ohio
01121	Allen-Bradley Co. Milwaukee, Wisconsin
01661	Wilrite Products, Inc. Cleveland, Ohio
02660	Amphenol-Borg Electronics Corp. Broadview, Illinois
02735	Semiconductor Div. of Radio Corp. of America Somerville, N. J.
02777	Hopkins Engineering Co. San Fernando, Calif.
04713	Motorola Semiconductor Products, Inc. Phoenix, Arizona
06980	Eitel-McCullough, Inc. San Carlos, Calif.
07065	Line Electric Co. Newark, N. J.
12080	Chicago Standard Transformer Corp. Chicago, Illinois
12697	Clarostat Mfg. Co., Inc. Dover, N. H.
14655	Cornell-Dubilier Electric Corp. Newark, N. J.
15909	Daven Co. Livingston, N. J.
19701	Electra Mfg. Co. Kansas City, Mo.
24446	General Electric Co. Schenectady, N. Y.
37942	Mallory, P. R., and Co., Inc. Indianapolis, Ind.
44655	Ohmite Mfg. Co. Skokie, Ill.
49956	Raytheon Co. Lexington, Mass.
63743	Ward Leonard Electric Co Mount Vernon, N. Y.
71450	CTS Corp. Elkhart, Ind.
71590	Centralab Div. of Globe-Union, Inc. Milwaukee, Wisc.
72619	Dialight Corp. Brooklyn, N. Y.
72928	Erie Resistor Corp. Erie, Pa.
72982	Gudeman Co. Chicago, Ill.
73445	Amperex Electronic Co. Di No. Amer. Philips Co., In Hicksville, N. Y.
75042	International Resistance Philadelphia, Pa.
75915	Littelfuse, Inc. Des Plaines, Ill.
80164	Keithley Instruments, Inc Cleveland, Ohio
80183	Sprague Products Co. North Adams, Mass.
83125	General Instrument Co. Capacitor Division Darlington, S. C.
86684	RCA Electronic Tube Div. Radio Corp. of America Harrison, N. J.
91637	Dale Electronics, Inc. Columbus, Nebr.
91929	Minneapolis-Honeywell Reg Micro Switch Division Freeport, Ill.
94696	Magnacraft Electric Co. Chicago, Ill.
95970	Milwaukee Transformer Co. Milwaukee, Wisc.
99120	Plastic Capacitors, Inc. Chicago, Ill.



NOTE:
1) UNLESS OTHERWISE SPECIFIED, ALL CAPACITANCE & RESISTANCE IS SHOWN IN MICROFARADS & OHMS RESPECTIVELY

K= 1,000 OHMS
M= 1,000,000 OHMS
3. ○ FRONT PANEL ADJ.
⊘ INTERNAL ADJ.

4. MEASUREMENTS MADE WITH hp VTVM PLUS 500 VOLTS OUTPUT REF. GND EXCEPT WHERE INDICATED
* ADJUSTED AT FACTORY

TITLE: HIGH VOLTAGE POWER SUPPLY	KEITHLEY INSTRUMENTS, INC. CLEVELAND, OHIO
DRAWN RTF DATE 1-3-62	DRAWING NUMBER
CHECKED AV DATE 2-12-62	14661 D
APPROVED DATE	

A PRODUCTION 7-18-62 RFL

WARRANTY

We warrant each of our products to be free from defects in material and workmanship. Our obligation under this warranty is to repair or replace any instrument or part thereof, except tubes, transistors, fuses, and batteries, which, within a year after shipment to the original buyer, proves defective on examination.

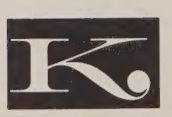
DAMAGE IN SHIPMENT

Be sure to include the instrument model number and serial number in all communications.

If the instrument is damaged when received, or fails to operate properly, a claim should be filed with the carrier. Upon receipt of the claim agent's report, we will inform you regarding repair or replacement.

REPAIRS

When returning an instrument for repair or recalibration, it should be securely packed against shipping damage and sent to the factory, freight prepaid. A brief letter describing the difficulty should accompany the instrument.



KEITHLEY INSTRUMENTS, INC.
12415 EUCLID AVENUE CLEVELAND 6, OHIO

L. LOUIS SNITZER CO.
LOS ANGELES

SEP 28 1962

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